

## 11. SOME OBSERVATIONS ON THE GEOGRAPHIC VARIATION OF MIXED-SPECIES BIRD FLOCKS IN SRI LANKA<sup>1</sup>

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Mixed-species bird flocks are a prominent feature of the avifauna of the Indian subcontinent. Many species participate in flocks, in at least some of their range, as frequently noted in the species accounts by Ali and Ripley (1987). In some areas, such as the Sinharaja World Heritage Reserve in Sri Lanka, the majority of common species are more readily observed inside of mixed flocks than outside of them (Kotagama and Goodale 2004). Descriptions of flock systems in different parts of the Subcontinent are now beginning to accumulate (Partridge and Ashcroft 1976; MacDonald and Henderson 1977; Robin and Davidar 2002; Kotagama and Goodale 2004).

One limitation in most flock studies is that they are conducted at one field site (see, however, Robin and Davidar 2002 for a comparison between teak plantations and moist deciduous forest). The question then arises as to how representative these studies are of flocks in the geographical region, where 'region' may be defined at different spatial scales. In Sri Lanka, flock systems have been described at montane elevations (approximately 2000 m above msl, Partridge and Ashcroft 1976), and at low elevations in the wet-zone (approximately 500 m above msl, Kotagama and Goodale 2004). The kinds of flocks that occur at intermediate elevations are hitherto unknown.

We undertook a short-term study to investigate altitudinal variation, within a 20 km radius area, around our main research site in the Sinharaja World Heritage Reserve, where flock studies have been going on since 1981 (Kotagama and Goodale 2004). A total of 10 transects were placed in the Sinharaja Reserve, the Delwala Proposed Forest Reserve and the Walankanda Forest Reserve. Transects were placed inside forests with continuous canopy, either in primary forest, or in secondary forest, logged in the 1970s and 1980s and was now at least 15 m in height. Transects were positioned at a distance of at least 250 m, and at different elevations – four between 400-600 m above msl, three between 600-800 m, and three between 800-1100 m. Each transect was 0.75 km long, except for one 0.5 km transect in the Walankanda Reserve, where bamboo thickets made walking difficult.

We visited each transect for at least three and up to six consecutive days, spending at least three days without rain

at each transect, for a total of 42 days. We started observations at 0630 hrs and walked up and down the transect till 1630 hrs, with scattered breaks. A flock was not included in the analysis, if another flock had been seen earlier during the day within 250 m. We, however, counted flocks that were seen in the same 250 m area on separate days. These flocks undoubtedly contained some individuals from earlier flocks; however, as flocks re-form every morning we consider them independent observations (see also discussion of independence in Kotagama and Goodale 2004). Visits to the different transects were scattered between January 29 and June 25, 1998. During extensive fieldwork in the Sinharaja Reserve, we found seasonal variation in flock composition and size to be low (Kotagama and Goodale 2004).

A majority of the flocks encountered (42 of 58) were similar to flocks previously described by us from the Sinharaja Reserve, as they centred around the gregarious Ceylon Rufous Babbler (*Turdoides rufescens*) and included a high number of species and individuals (an average of 10.4 species and 31 individuals). In particular, these babbler-led flocks included three of Sri Lanka's endemic and vulnerable species (BirdLife International 2001) – 23 flocks included Ashy-headed Laughingthrush (*Garrulax cinereifrons*), 17 flocks included Ceylon Starling (*Sturnus albofrontatus*), and 15 flocks included Red-faced Malkoha (*Phaenicophaeus pyrrhocephalus*). At least two of these three species were seen in 18 babbler-led flocks, and the three species were found in such flocks in all the forest reserves. However, these species were rarely involved in flocks without babblers (laughingthrushes were found in one such flock, malkohas and starlings in none).

Flocks without babblers were found primarily on the transect at the lowest elevation (all of the six flocks found on the 400 m transect in the Delwala Reserve), and on the transect at the highest elevation (five of the eight flocks found on the 1100 transect near the former Morningside Estate in the eastern sector of the Sinharaja Reserve). Such flocks were substantially smaller than those that included babblers (averaging 7.4 species and 15 individuals; comparison to babbler-led flocks, two sample t-tests,  $t_{56} = 2.69$ ,  $P < 0.01$  for species, and  $t_{56} = 4.37$ ,  $P < 0.001$  for individuals). At the lowest

elevation transect, babblers were not present inside or outside flocks, during our visit. The one constant in flocks at this transect was the presence of Greater Racket-tailed Drongos (*Dicrurus paradiseus*), which were in every flock, and for the entire observation period. At the highest elevation transect, flocks similar to the montane system co-existed with the larger babbler-led system. These flocks were led by the Ceylon White-eye (*Zosterops ceylonensis*) and the Grey-headed Flycatcher (*Culicicapa ceylonensis*), the two most numerous species in the montane system (Partridge and Ashcroft 1976). Three times we saw these montane-like flocks join a babbler-led flock and then split away less than half an hour later.

The observation that several of the vulnerable species that participate in flocks were found almost exclusively with Ceylon Rufous Babblers, indicates the importance of babblers for other birds that associate with them. Babblers have all the characteristics of 'nuclear' species in flocks (*in sensu* Moynihan 1962, Hutto 1994); they are found in most flocks, are rarely found outside of them, and lead the flocks (Kotagama and Goodale 2004). Other species are attracted to the playback of the calls of this species (Goodale and Kotagama 2005b).

Observations of flocks without babblers at the lowest elevation transect suggest that the Greater Racket-tailed Drongo can also be considered a nuclear species. Drongos are frequent members of babbler-led flocks and are rarely found outside flocks. However, their role in flocks is not as clear as that of the Ceylon Rufous Babbler, because they lead fewer flocks than do babblers, and also are inter-specifically aggressive, sometimes stealing food from other species (King and Rappole 2001). We have previously argued that drongos may be beneficial to other species because they make reliable and sensitive alarm calls (Goodale and Kotagama 2005a), and that they should be considered nuclear species, because like babblers, their calls attract other species in playback trials (Goodale and Kotagama 2005b). The observations on the lowest elevation transect support this idea, by demonstrating that mixed flocks form around drongos, when babblers are absent.

Observations at the highest elevation transect demonstrate that montane-like flocks may co-exist with lowland flocks in areas of intermediate elevation. One question raised by these observations is whether species prefer to participate with one flock system more than the other. We found that the smaller sized species associated with the

montane-like flocks, the nine most frequent species in them (present in at least two of five flocks), averaged 23.8 g, whereas the eight most frequent species in the babbler-led flocks at the same transect (present in at least two of three flocks) averaged 50.1 g (two sample t-test,  $t_{14} = 2.25$ ,  $P < 0.05$ ; weight data from Ali and Ripley 1987 and, if not available, estimated from closely related, similarly sized species). Separate flock systems with birds of different sizes have also been described from New Guinea (Bell 1983). Such a phenomenon might arise if birds prefer to associate with other species that share the same predators, particularly since the species' propensity to flock is associated with their vulnerability to predation (Thiollay and Jullien 1998).

While this study shows that certain phenomena, such as flocks centred around drongos, and separate flock systems co-existing in intermediate elevations exist, our understanding of how flocks vary by elevation would clearly be expanded by further sampling in different areas and over longer time intervals. Similar studies should also determine how land-use patterns affect flocks. Management plans that target a flock system, or a nuclear species like the Ceylon Rufous Babbler, may benefit several threatened species that participate in flocks, such as the Ashy-headed Laughingthrush, the Red-faced Malkoha, and the Ceylon Starling. A few studies in the neotropics have shown that participants of flocks may be particularly vulnerable to disturbance, and sometimes the whole flock system may disappear (Thiollay 1992; Stouffer and Bierregaard 1995). Such studies are needed on the Indian subcontinent to develop community-wide conservation strategies.

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12. ADDITIONS TO THE AVIFAUNA OF GOA, INDIA<sup>1</sup>

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The first report on the birds of Goa in 1976 recorded 154 species (Grubb and Ali 1976). Subsequently Saha and Dasgupta (1992) raised the number of species to 208. All the reports thus far were based on opportunistic surveys, mostly of forested regions, none of them exceeding 16 days. In 1996, the ecological research on wetlands and waterbirds of the state was initiated at three freshwater bodies (Walia and Shanbhag 1996; Shanbhag *et al.* 2001). Around the same time, Lainer (1999a, b) reported 382 species, increasing the number of avian species of Goa to 174.

However, not much was known of the ecology and bird fauna of estuarine wetlands in the state. The Sálím Ali Bird Sanctuary, the only one of its kind in the state within the estuarine belt, though notified in 1988, was not an exception. Therefore, a detailed three year study was initiated to understand the ecology of the Mandovi estuarine wetland in general and its avifauna in particular (Borges 2003). In the course of this study, encompassing the deltaic islands of Choraó, Diwar, Choraó Minor and the estuarine banks of Ribandar (Fig. 1), observations were carried out by boat as well as on foot, using 12 x 25 binoculars and a 15-45 x 60 spotting scope. Birds were identified using standard field guides (Sonobe and Usui 1993; Ali 1996; Grimmett *et al.* 1998).

During the study, a total of 151 species, both resident and migratory birds were recorded, eight of which were new sightings or confirmations for the Goa region.

These eight species were sighted on more than one occasion. This paper records sightings, microhabitat utility and behavioural attributes of these species.

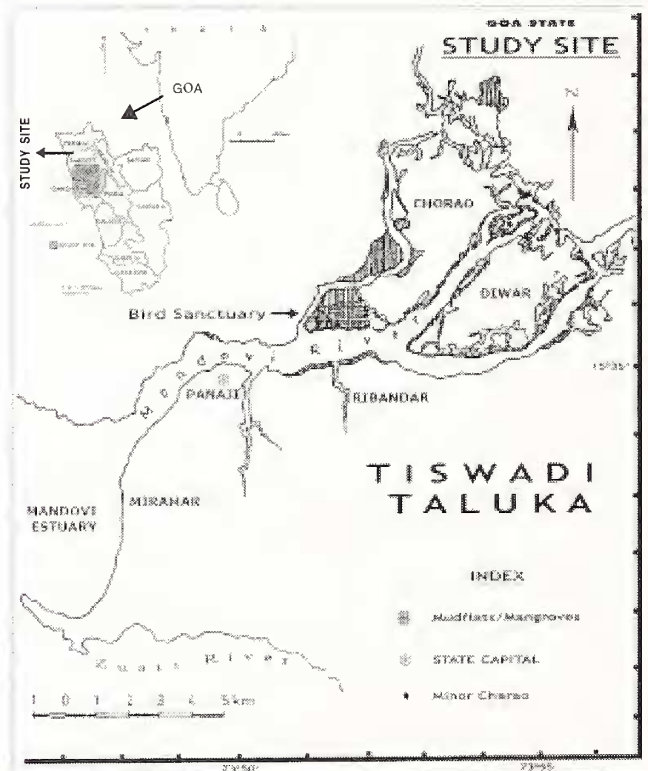


Fig. 1: Map of the study site